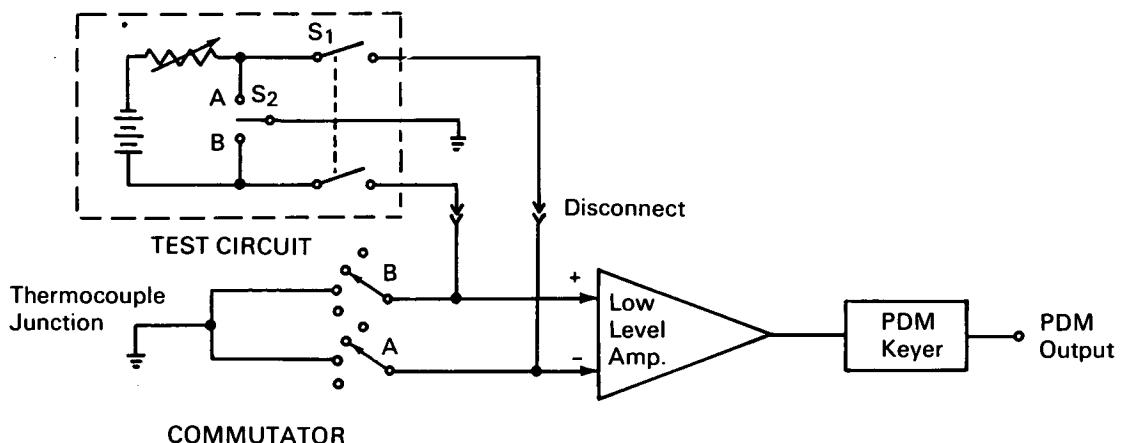


# NASA TECH BRIEF



NASA Tech Briefs are issued to summarize specific innovations derived from the U.S. space program, to encourage their commercial application. Copies are available to the public at 15 cents each from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

## Thermocouples Electrically Checked While Connected to Data System



### The problem:

To monitor the electrical continuity and resistance of multiple thermocouple installations without disconnecting them from a data system.

### The solution:

A constant current source is connected across the input of the millivolt measuring system. As each thermocouple is sampled, the system output voltage is a direct function of the thermocouple loop resistance.

### How it's done:

A constant current source consisting of a battery and adjustable resistor is connected across the PDM (Pulse Duration Modulation) output of the commutator in proper polarity. As each thermocouple loop is sampled by the commutator, the voltage across the loop is proportional to its resistance and the voltage readout signal is a measure of this resistance. The current source is adjusted so the voltage across a known resistance, greater than the resistances to be

measured, equals the full scale range of the data system. A readout is first taken with  $S_1$  open to confirm the absence of tare voltages. A readout with  $S_1$  closed then directly reflects the thermocouple resistances, with the readout for an open circuit depending on system limiting characteristics. Placing  $S_2$  in the A or B positions provides a measurement of the resistance of each leg of the thermocouple circuit if the junction is grounded and the measuring system has differential inputs as indicated.

### Notes:

1. This technique was evolved and used for periodic monitoring of the condition of a large number of very small gage thermocouple leads during the assembly and preflight testing of the Project Fire reentry packages.
2. Typical resistances measured ranged from 20 to 400 ohms. The test circuit was set for 0.1 milliampere so that the 50 millivolt range of the system represented 500 ohms full scale.

(continued overleaf)

3. While a PDM system is shown, the technique should be equally usable with PAM (Pulse Amplitude Modulation) or other modulation systems.
4. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer  
Langley Research Center  
Langley Station  
Hampton, Virginia 23365  
Reference: B66-10623

**Patent status:**

No patent action is contemplated by NASA.

Source: Republic Aviation Corporation  
under contract to  
Langley Research Center  
(Langley-182)